

Results of Groundwater Monitoring for the 183-H Solar Evaporation Basins

Reporting Period: July-December 2005

RECEIVED
APR 26 2006

EDMC

A Letter Report Prepared by
M. J. Hartman
Pacific Northwest National Laboratory
Richland, Washington

March 2006

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or Battelle Memorial Institute.

PACIFIC NORTHWEST NATIONAL LABORATORY

operated by

BATTELLE

for the

UNITED STATES DEPARTMENT OF ENERGY

under Contract DE-AC05-76RL01830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831;
prices available from (615) 576-8401.

Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161



This document was printed on recycled paper.

Results of Groundwater Monitoring for the 183-H Solar Evaporation Basins

Reporting Period: July-December 2005

M. J. Hartman

March 2006

Prepared for
the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Pacific Northwest National Laboratory
Richland, Washington

This letter report has been prepared to provide the U.S. Department of Energy, U.S. Environmental Protection Agency, Washington State Department of Ecology, and Hanford Site contractors with updated groundwater monitoring information. It is not intended for general distribution beyond that audience.

INTRODUCTION

The 183-H solar evaporation basins (183-H basins) were located in the 100-H Area of the Hanford Site and have been demolished and backfilled under the *Resource Conservation and Recovery Act* (RCRA) in the Hanford Facility RCRA Permit (Ecology 2004). Post-closure actions remain for the 183-H basins. Groundwater is monitored in accordance with Washington Administrative Code (WAC) 173-303-645(11), "Corrective Action Program," and Part VI, Chapter 2 of the Hanford Facility RCRA Permit (Ecology 2004). The waste discharged to the basins originated in the 300 Area fuel fabrication facility and included solutions of chromic, hydrofluoric, nitric, and sulfuric acids that had been neutralized. The waste solutions contained various metallic and radioactive constituents (e.g., chromium, technetium-99, uranium¹). Between 1985 and 1996, remaining waste was removed, the facility was demolished, and the underlying contaminated soil was removed and replaced with clean fill.

This is one of a series of reports on corrective action monitoring at the 183-H basins. It fulfills a requirement of WAC 173-303-645(11)(g) to report twice each year on the effectiveness of the corrective action program. This report covers the period from July through December 2005.

The regulations in WAC 173-303-645(11) require corrective action activities to reduce contaminant concentrations in groundwater. The post-closure plan (DOE 1997a), which was incorporated into Part VI of the Hanford Facility RCRA Permit in February 1998, deferred further actions at the 183-H basins to the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) interim action for the 100-HR-3 Operable Unit. The post-closure plan also requires monitoring to be conducted as described in the final status RCRA groundwater monitoring plan (Hartman 1997).

INTERIM REMEDIAL MEASURE

The interim remedial action applies to the 100-HR-3 groundwater operable unit, which is under the authority of a CERCLA record of decision. Groundwater in the 100-H Area is pumped from extraction wells, treated to remove chromium, and injected back into the aquifer. The objective of the interim remedial measure is to reduce the amount of chromium entering the Columbia River, where it is a potential hazard to the ecosystem. Active extraction and injection wells for this reporting period are listed in Table 1.

¹ Groundwater monitoring objectives of RCRA, CERCLA, and the *Atomic Energy Act* (AEA) often differ slightly and the contaminants monitored are not always the same. For RCRA regulated units, monitoring focuses on non-radioactive dangerous waste constituents. Radionuclides (source, special nuclear and by-product materials) may be monitored in some RCRA unit wells to support objectives of monitoring under the AEA and/or CERCLA. Please note that pursuant to RCRA, the source, special nuclear and by-product material component of radioactive mixed wastes, are not regulated under RCRA and are regulated by DOE acting pursuant to its AEA authority. Therefore, while this report may be used to satisfy RCRA reporting requirements, the inclusion of information on radionuclides in such a context is for information only and, may not be used to create conditions or other restrictions set forth in any RCRA permit.

Note that well 199-H4-7 began use as an injection well in August 2005, ending its usefulness for RCRA monitoring (see "RCRA Groundwater Monitoring Program" below).

Groundwater is sampled to monitor the performance of the interim remedial measure and to monitor the entire 100-HR-3 Operable Unit (DOE 1997b). This CERCLA monitoring is coordinated with RCRA monitoring.

The pump-and-treat system may be shut down when concentrations of hexavalent chromium are below 22 µg/L in the extraction and compliance wells as specified in the Remedial Design Report and Remedial Action Work Plan (DOE 2003) and data indicate that the concentration will remain below that value. The system may also be shut down if it proves ineffective or if a better treatment technique is found. The most recent operable unit report, covering calendar year 2004, concluded that chromium concentrations in groundwater are not consistently below 22 µg/L in the extraction and compliance wells (DOE 2005). However, chromium concentrations are below the 100-µg/L drinking water standard at these wells and chromium levels in aquifer tubes along the Columbia River are near the aquatic standard.

RCRA GROUNDWATER MONITORING PROGRAM

During the period of time that the CERCLA interim remedial measure for chromium is extracting groundwater, RCRA corrective action monitoring will continue to evaluate new analytical results relative to concentration limits stated in the permit. Additionally, fluoride results will be evaluated relative to previously established trends and to the drinking water standard for drinking water (Attachment 37, Chapter 3 of the Hanford Facility RCRA Permit [Ecology 2004]).

Until this reporting period, the RCRA groundwater monitoring network included wells 199-H4-3, 199-H4-7, 199-H4-12A, and 199-H4-12C (Figure 1). The conditions in Attachment 37, Chapter 3 of the Hanford Facility RCRA Permit (Ecology 2004) provide for groundwater sample collection annually in these wells. Well 199-H4-7 was converted to an injection well in August 2005 (see Table 1), so it is no longer suitable for RCRA monitoring. The U.S. Department of Energy (DOE) and Washington State Department of Ecology agreed that well 199-H4-8 will be monitored instead of well 199-H4-7.²

Field crews completed the annual sampling of wells 199-H4-3, 199-H4-12A, and 199-H4-12C in November as scheduled. Well 199-H4-8 was added to the network after the reporting period and will be sampled for RCRA in March 2006. All of the wells were sampled for the 100-HR-3 Operable Unit at various times in the reporting period. The contaminants of interest for groundwater are chromium, nitrate, fluoride, technetium-99, and uranium. Of these, only chromium is a listed dangerous waste constituent subject to regulation under RCRA. However, all five constituents continued to be monitored because they are included by reference in the Hanford Facility RCRA Permit.

² Hanford Facility RCRA Permit Modification Notification Form, Part VI, Chapter 2, 183-H Solar Evaporation Basins, quarter ending March 31, 2006.

Well 199-H4-12A has been an extraction well since 1997, and well 199-H4-3 was converted to an extraction well in August 2005. Wells 199-H4-3, 199-H4-7, 199-H4-8, and 199-H4-12A are completed at the top of the unconfined aquifer. Well 199-H4-12C is located adjacent to well 199-H4-12A and is completed deeper in the Ringold Formation. This well consistently has elevated concentrations of chromium without 183-H basins co-contaminants.

CONTAMINANT TRENDS

This section discusses concentrations of chromium, fluoride, nitrate, technetium-99, and uranium in groundwater. Results of samples collected during the reporting period are presented in Table 2, and pertinent results are discussed in the following paragraphs. Available data from well 199-H4-8 are included in the tables, figures, and discussion because this well will substitute for well 199-H4-7 beginning in 2006.

In the shallow wells, chromium concentrations ranged from <10 $\mu\text{g/L}$ (wells 199-H4-7 and 199-H4-8) to 63 $\mu\text{g/L}$ (well 199-H4-12A) during the reporting period. Concentrations declined in wells 199-H4-3, 199-H4-7, and 199-H4-8 to the lowest levels ever observed in those wells (Figure 2). Concentrations remained steady overall in well 199-H4-12A, located near the Columbia River and affected by changing river stage. Chromium levels dropped below the 100- $\mu\text{g/L}$ drinking water standard for the first time in deep well 199-H4-12C during the reporting period (94 to 99.5 $\mu\text{g/L}$). The source of this deeper chromium is unknown; other 183-H basins waste constituents are not elevated in the well. All of the chromium results were less than the 122- $\mu\text{g/L}$ concentration limit (see Table 2).

Fluoride levels during the reporting period ranged from 87 to 170 $\mu\text{g/L}$ (see Table 2). These levels are no higher than those observed in upgradient wells and are far below the 4,000- $\mu\text{g/L}$ concentration limit.

Nitrate concentrations continued to exceed the 45-mg/L concentration limit in the shallow wells, ranging from 51.4 to 142 mg/L. The highest levels were in well 199-H4-12A, which showed an increasing trend since 2004 (Figure 3). The concentration decreased in well 199-H4-3 and remained steady in well 199-H4-7. Nitrate concentrations continued to be very low (3.5 mg/L) in deep well 199-H4-12C.

The technetium-99 concentrations in well 199-H4-3 were lower than they have ever been (87 and 130 pCi/L; Figure 4). Concentrations increased in well 199-H4-12A but remained below the 900-pCi/L concentration limit (340 and 463 pCi/L). Technetium-99 remained undetected in deep well 199-H4-12C.

Uranium concentrations (Figure 5) ranged from 1.5 $\mu\text{g/L}$ in deep well 199-H4-12C to 57.2 $\mu\text{g/L}$ in well 199-H4-12A. The recent results in well 199-H4-12A exceeded the 20- $\mu\text{g/L}$ concentration limit (see Table 2) and were among the highest ever detected in the well, but there is no clear trend over time.

CONCLUSIONS

The current objective of RCRA corrective action monitoring is simply to track trends, not to determine the effectiveness of the interim remedial action. The current RCRA permit (Attachment 37, Chapter 3 of Ecology [2004]), and monitoring plan (Hartman 1997), as revised by the 2006 Hanford Facility RCRA Permit Modification, remain adequate for the objective of tracking trends during the period of the interim remedial action.

REFERENCES

Atomic Energy Act. As amended, Ch. 1073, 68 Stat. 919, 42 USC 2011 et seq.

Comprehensive Environmental Response, Compensation, and Liability Act. 1980. Public Law 96-510, as amended, 94 Stat. 2767, 42 USC 9601 et seq.

DOE. 1997a. *183-H Solar Evaporation Basins Postclosure Plan*. DOE/RL-97-48, Rev. 0, U.S. Department of Energy, Richland, Washington.

DOE. 1997b. *Interim Action Monitoring Plan for the 100-HR-3 and 100-KR-4 Operable Units*. DOE/RL-96-90, U.S. Department of Energy, Richland, Washington.

DOE. 2003. *Remedial Design and Remedial Action Work Plan for the 100-HR-3 and 100-KR-4 Groundwater Operable Units' Interim Action*. DOE/RL-96-84, Rev. 0-A, U.S. Department of Energy, Richland, Washington.

DOE. 2005. *Calendar Year 2004 Annual Summary Report for the 100-HR-3 and 100-KR-4, and 100-NR-2 Operable Unit Pump-and-Treat Operations*. DOE/RL-2005-18, U.S. Department of Energy, Richland, Washington.

Ecology. 2004. *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*. Permit No. WA7890008967, Rev. 8, September 2004, as amended, Washington State Department of Ecology, Olympia, Washington.

Hartman MJ. 1997. *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins*. PNNL-11573, Pacific Northwest National Laboratory, Richland, Washington.

Resource Conservation and Recovery Act. 1976. Public Law 94-580, as amended, 90 Stat. 2795, 42 USC 6901 et seq.

WAC 173-303-645. *Release from Regulated Units*. Washington Administrative Code, Olympia, Washington.

Table 1. 100-HR-3 Extraction and Injection Wells in the 100-H Area	
January to August 2005	August 2005 to January 2006 ^(a)
Extraction Wells	
199-H4-4	199-H4-3
199-H4-11	199-H4-4
199-H4-12A	199-H4-12A
199-H4-15A	199-H4-15A
199-H4-64	199-H4-63
199-H4-65	199-H4-64
Injection Wells	
199-H3-2A	199-H3-2A
199-H4-18	199-H4-7
199-H3-5	199-H4-17
	199-H4-18
(a) In January 2006, well 199-H4-14 was substituted for 199-H3-2A as an injection well.	

Table 2. Groundwater Data for 183-H Basins, July through December 2005.

Well	Sample Date	Chromium, µg/L		Fluoride, µg/L	Nitrate, mg/L	Tc-99, pCi/L	Uranium, µg/L
Concentration Limit ^(a)		122		4,000	45	900	20
199-H4-12A	7/18/2005	28 ^(b)	Unf				
	9/7/2005	39 ^(b)	Unf				
	9/12/2005	52 ^(b)	Unf				
	9/20/2005	63 ^(b)	Unf				
	9/26/2005	54 ^(b)	Unf				
	10/3/2005	36 ^(b)	Unf				
	10/10/2005	56 ^(b)	Unf				
	10/17/2005	59 ^(b)	Unf				
	11/10/2005	54 ^(b)	Unf				
	11/21/2005	23 ^(b)	Unf				
	11/28/2005	34 ^(b)	Unf				
	12/1/2005	41.1^(c)	N Filt	130	142 D	463	45.6
	12/5/2005	39 ^(b)	Unf				
	12/12/2005	35 ^(b)	Unf				
	12/19/2005	35 ^(b)	Unf				
	12/28/2005	33 ^(b)	Unf		119	340	57.2 G
	12/28/2005	35 ^(b)	Unf				
	12/29/2005	50 ^(b)	Unf				
199-H4-12C	7/6/2005	98 ^(b)	Filt				
	11/21/2005	94 ^(b)	Filt				
	11/21/2005	99.5^(c)	Unf	87 BN	3.5 D	6.41 U	1.51
	11/21/2005	94.9 ^(c)	Filt				
199-H4-3	7/7/2005	12 ^(b)	Filt				
	9/7/2005	35 ^(b)	Unf				
	9/12/2005	39 ^(b)	Unf				
	9/20/2005	32 ^(b)	Unf				
	9/26/2005	31 ^(b)	Unf				
	10/3/2005	38 ^(b)	Unf				
	10/10/2005	21 ^(b)	Unf				
	10/17/2005	21 ^(b)	Unf				
	11/10/2005	12 ^(b)	Unf				
	11/21/2005	11 ^(b)	Unf				
	11/28/2005	18 ^(b)	Unf				
	11/29/2005	14.8^(c)	Filt	170	69.9 D	87.1	22.6
	12/5/2005	17 ^(b)	Unf				
	12/12/2005	23 ^(b)	Unf				
	12/19/2005	25 ^(b)	Unf				
199-H4-7	12/28/2005	20 ^(b)	Unf		61.5	130	26.2
	12/28/2005	19 ^(b)	Unf				
	12/29/2005	36 ^(b)	Unf				
	8/1/2005	14.7 ^(c)	Unf	170	51.4 D		
	8/1/2005	8.9 ^(c)	Filt				
199-H4-8	8/1/2005	10 ^(b)	Filt				
	7/8/2005	16.5 ^(b)	Filt				
	7/8/2005	20 ^(b)	Filt				
	11/22/2005	5 ^(b)	Filt				

(a) Concentration limits defined in Attachment 37, Chapter 3 of the Hanford Facility RCRA Permit (Ecology 2004). Chromium concentration limit was based on upgradient concentrations in 1995 (Hartman 1997). Uranium concentration limit (20 µg/L) was the proposed drinking water standard in 1997; the standard has been changed to 30 µg/L.

(b) Hexavalent chromium.

(c) Total chromium

Bold type indicates samples collected specifically for RCRA.

Filt = Chromium sample filtered.

Unf = Chromium sample unfiltered.

B = Less than contract-required detection limit but greater than method detection limit.

D = Sample diluted for analysis. Result corrected for dilution.

G = Record has been reviewed and determined to be correct, or the record has been corrected, with supporting evidence.

N = Spike sample recovery is outside control limits.

U = Below detection limit.

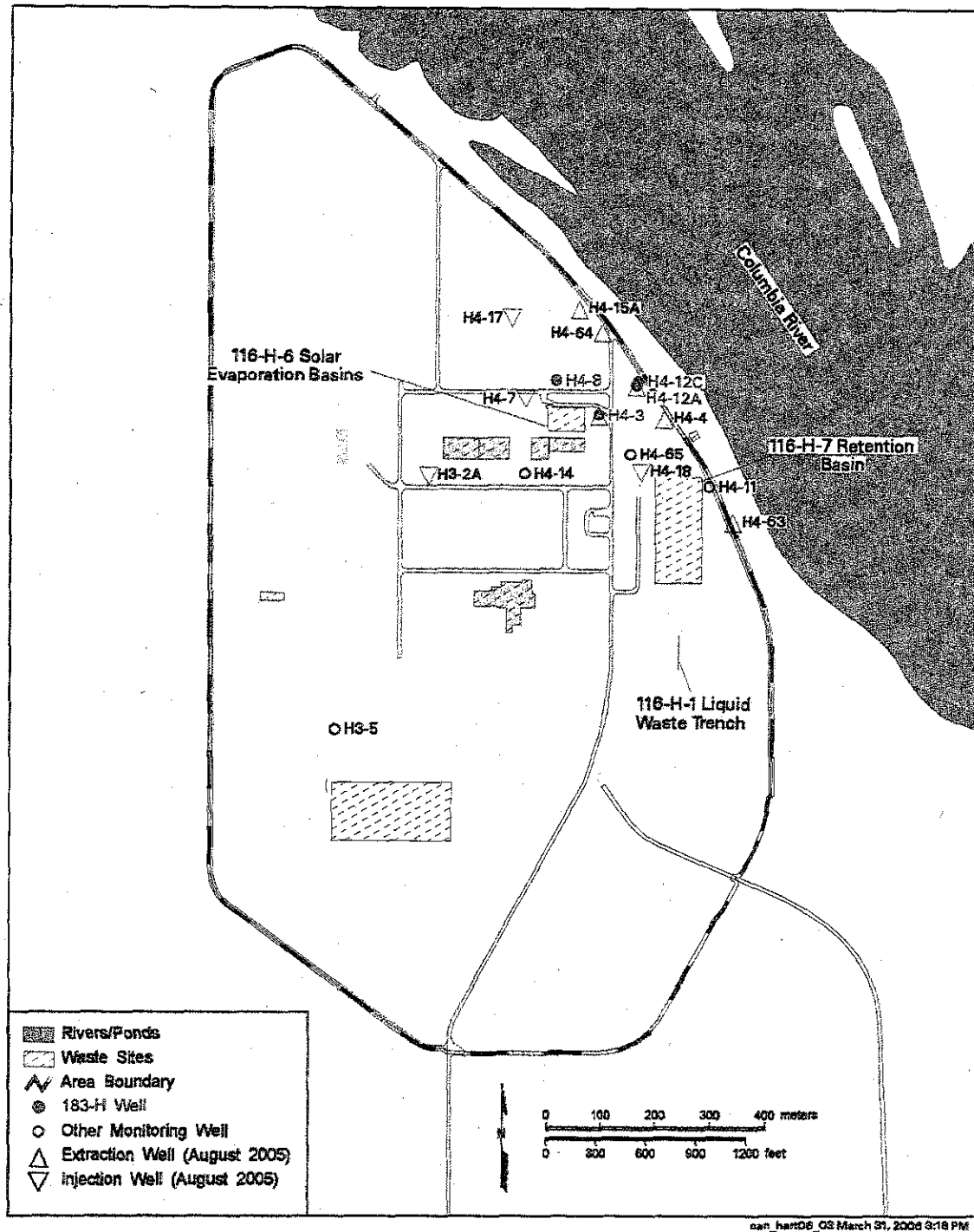


Figure 1. Monitoring Well Locations for 183-H (116-H-6) Basins

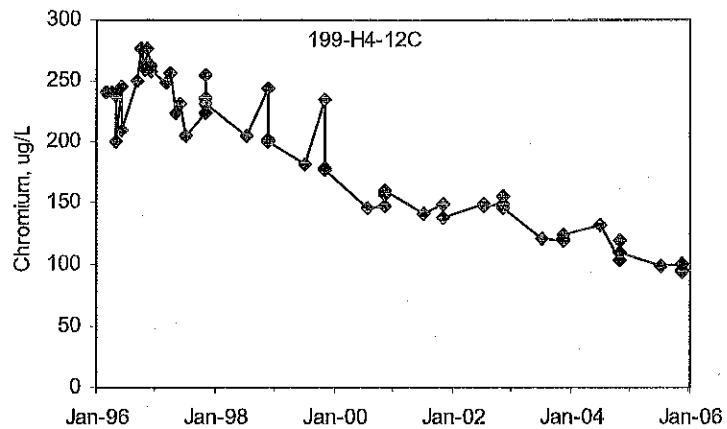
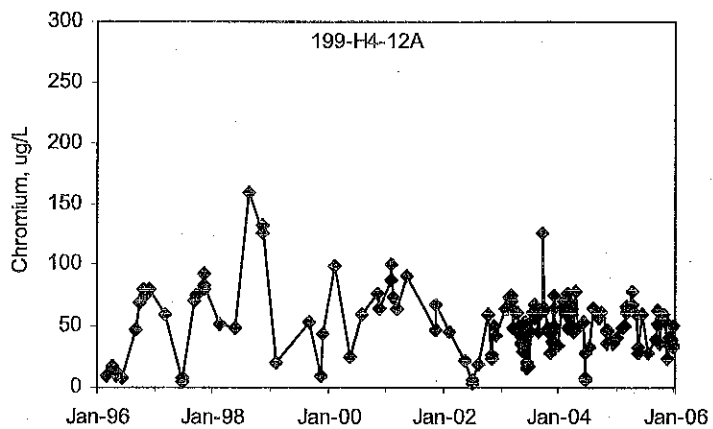
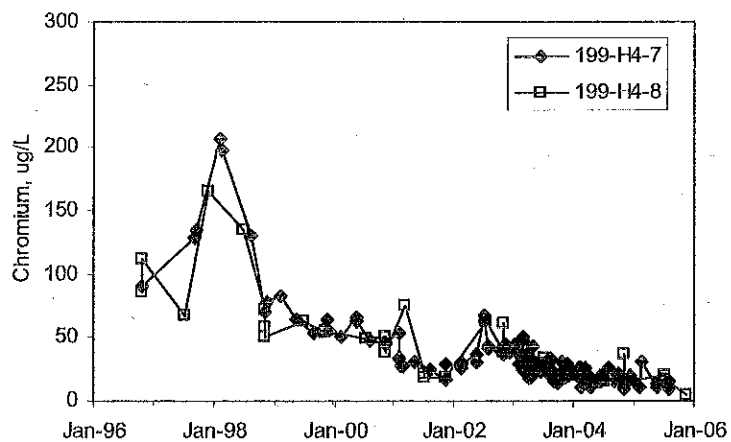
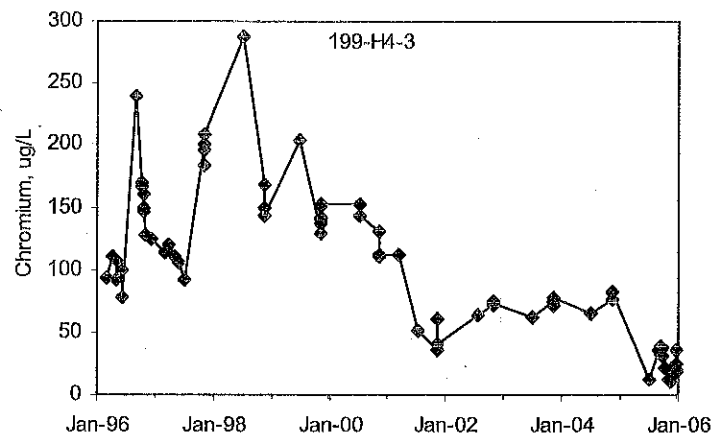


Figure 2. Chromium in Wells Monitoring 183-II Basins

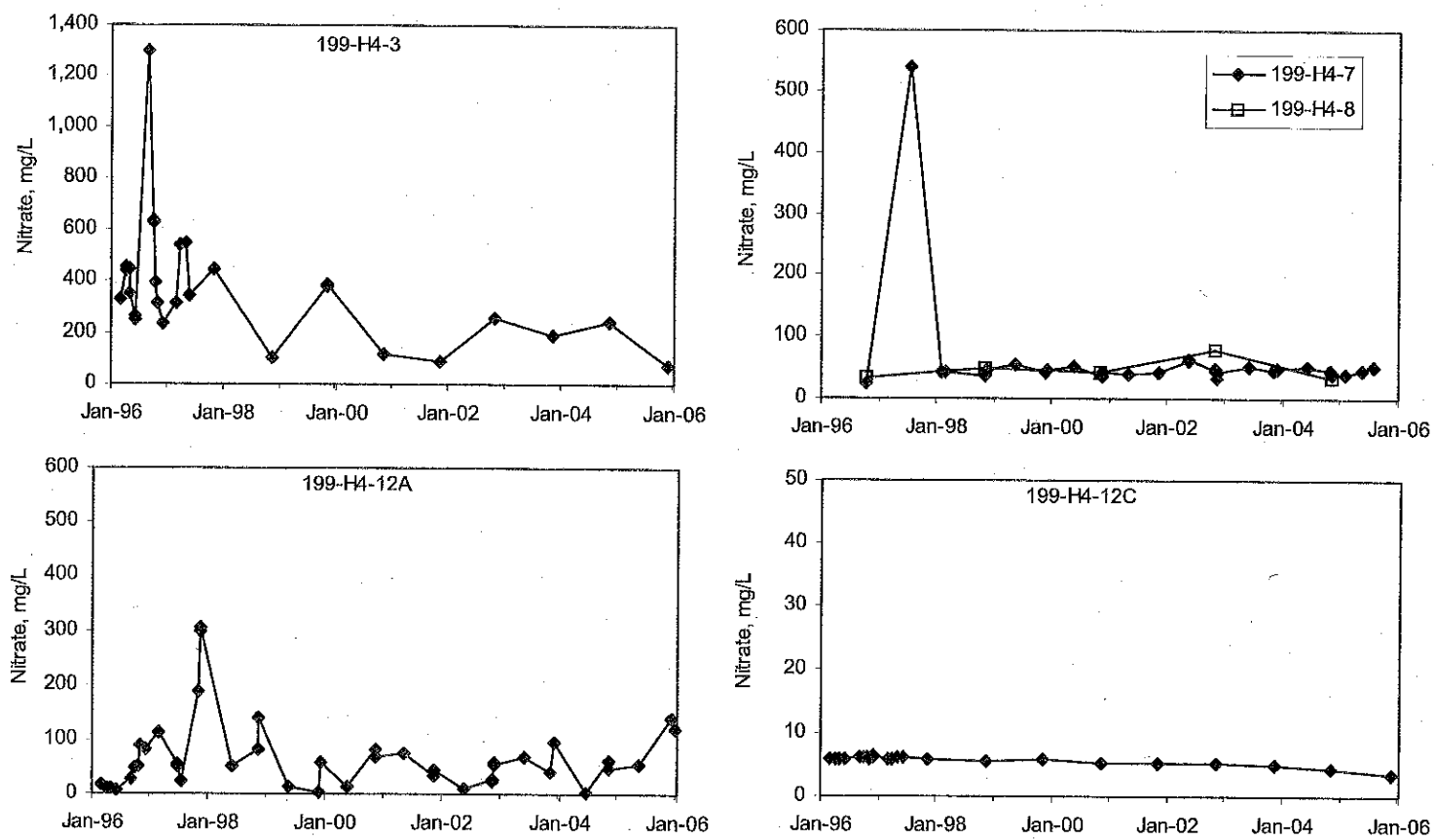


Figure 3. Nitrate in Wells Monitoring 183-H Basins

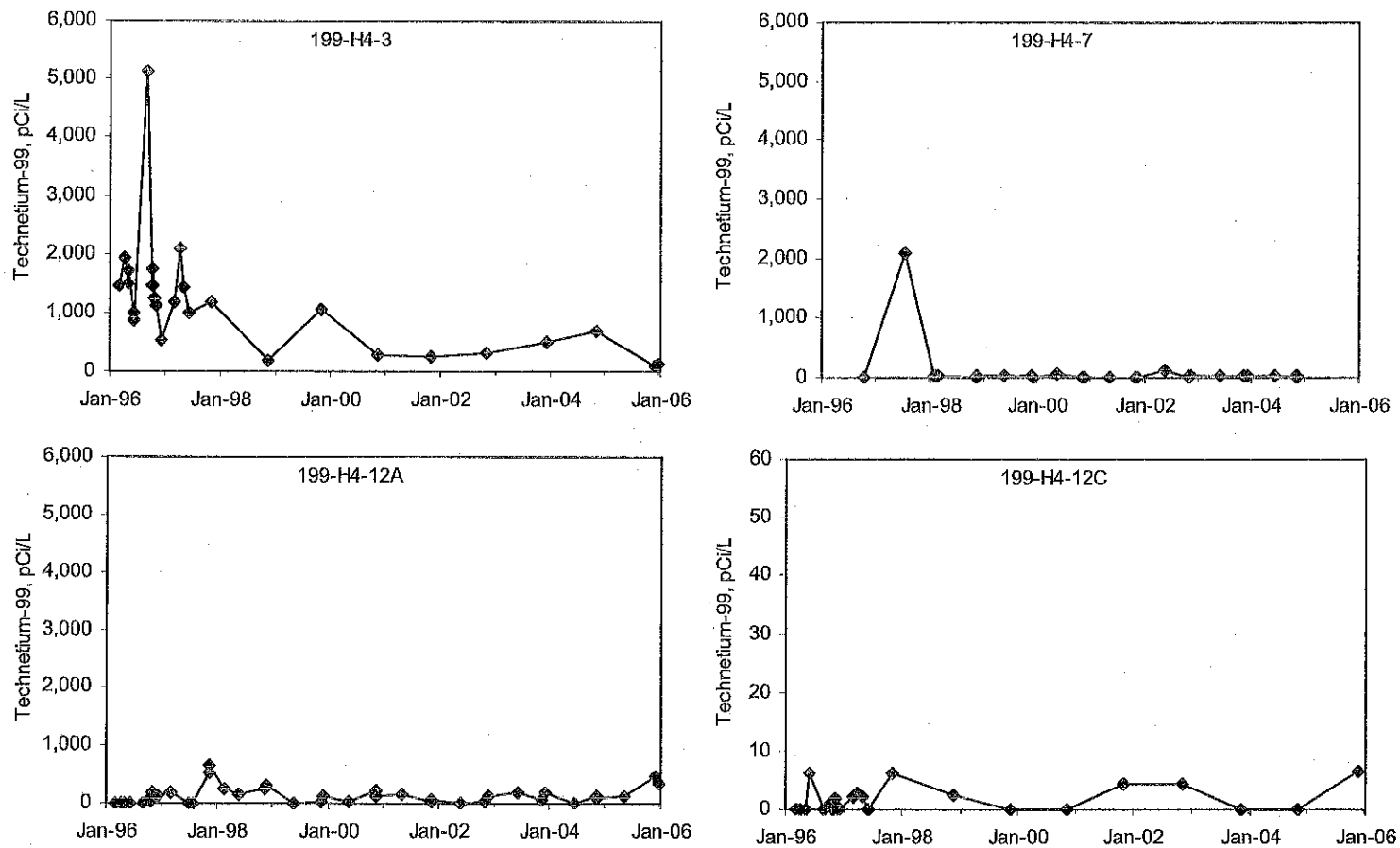


Figure 4. Technetium-99 in Wells Monitoring 183-H Basins

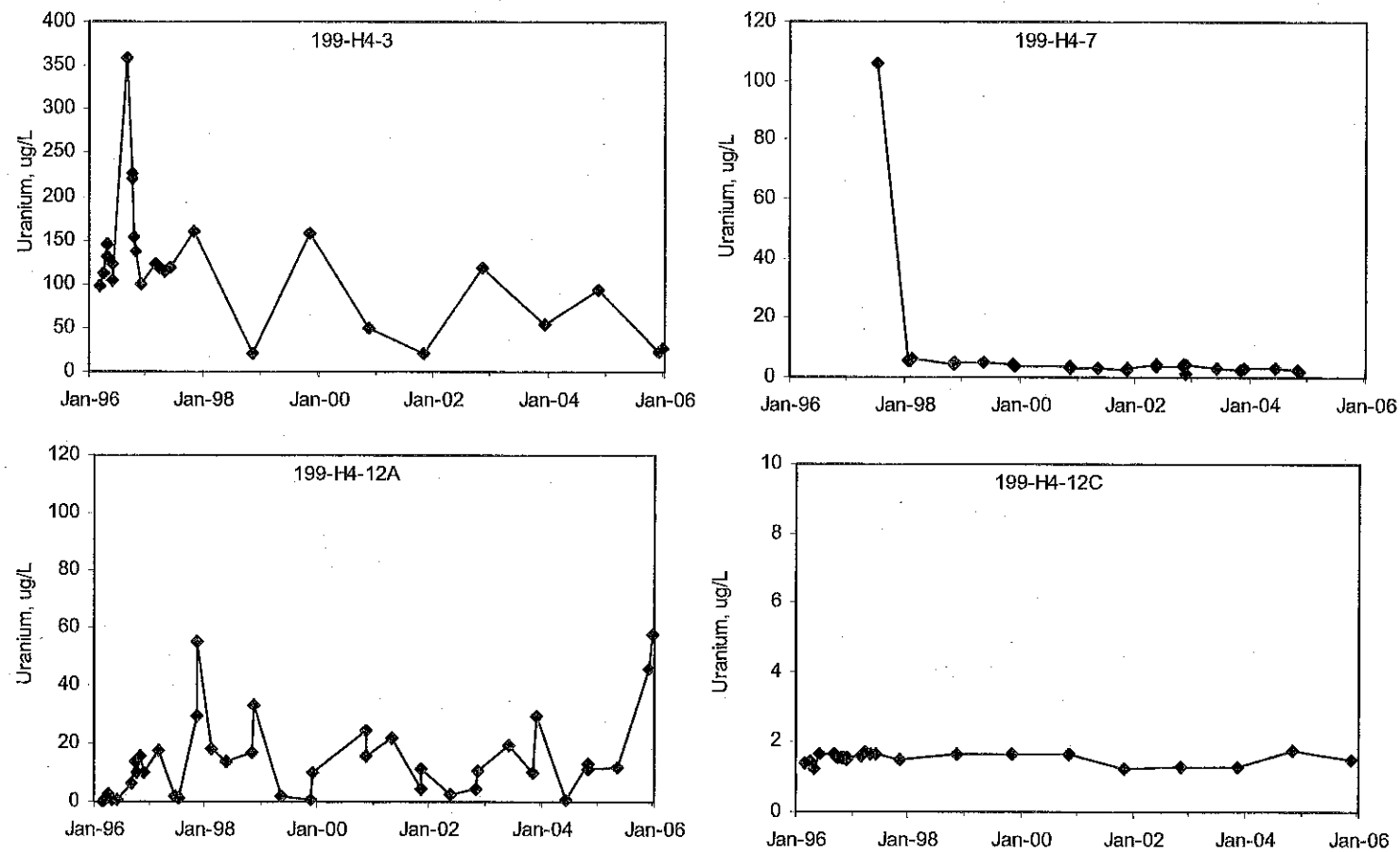


Figure 5. Uranium in Wells Monitoring 183-H Basins